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AN EXPERIMENTAL EVALUATION OF THE DISINFECTING ACTION OF BUV-ZOP BACTERICIDAL LAMPS ON SURFACES IN RELATION TO VEGETATIVE FORMS OF MICROORGANISMS

- USSR -

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AN EXPERIMENTAL EVALUATION OF THE DISINGECTING ACTION OF BUV-ZOP BACTERICIDAL LAMPS ON SURFACES IN RELATION TO VEGETATIVE FORMS OF MICROORGANISMS

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From the Military-Medical Order of Lenin Academy imeni S. M. Kirov

We attempted to study the interrelation between the density of bacterial seeding, protein and fat "protection," and the bactericidal effectiveness of BUV-ZOP lamps (Nos 566 and 605), because this question has not been sufficiently clarified in the literature.

Strains of B. coli and staphylococci used in the experiments met the standard requirements as to phenol- and heat-resistance. As protein "protection," normal horse serum inactivated for 30 minutes at a temperature of 58° was employed. The uniform seeding of the surface of objects was achieved by spraying a bacterial suspension in a box of 0.4 m^3 volume by means of a dye-sprayer. The precipitation of the bacterial aerosol formed in the chamber on the surface of objects took place for one hour and 30 minutes, following which the objects were removed from the box.

The objects were irradiated 12 to 15 minutes following the switching on of the lamp at temperatures of 18° to 20° and relative humidity within the limits of 58 to 72 percent. In one instance, the surfaces were irradiated without application of oils, in another -- they were covered with a layer of DS - 4749 - 49 diesel fuel or AU - 1642 - 50 spindle oil calculating 30 mm per square meter of surface. The control of disinfection was effected by means of qualitative and quantitative evaluation of the microorganisms on the irradiated surfaces by the generally accepted method (V. I. Vashkov, 1956).

In the first series, consisting of 120 tests (40 tests with a triple repetition of each variant), the infection density of the objects comprised 100, 1000, 10,000 and 100,000 microbic bodies per square centimeter of surface. Upon irradiation of 791 microwatts per square centimeter the B. coli could not be detected after 10-, 30-, and 60-minute irradiation in those cases where the seeding was calculated in small figures (100 and 1,000 microbic bodies per square centimeter and the microbic suspension did not maintain more than

20 percent protein "protection." Upon the presence of 20 percent protein "Protection," a 30- to 60-minute irradiation led to the complete destruction of B. coli on linoleum, resin, chrome-plated handle of the stand, and on the unpainted steel platform in infection doses of 100 and 1,000 microbic bodies per square centimeter. With the increase of seeding up to 10,000 and 100,000 microbic bodies per square centimeters without protein, as well as with 20 percent protein "Protection," we obtained an inconstant or strongly negative effect of irradiation.

In 180 tests (triple repetition of 60 variants) we used oils. When the surfaces were covered with spindle oil, at all densities of seeding (100, 1,000, 10,000 and 100,000 bacteria per square centimeter) and an exposure of 10, 30 and 60 minutes (irradiation of 791 microwatts/cm^2) there was no complete destruction of B. coli. In the presence of diesel oil on the objects and at dosage accepted by us (30 ml per square meter), the effectiveness of irradiation remained approximately the same as in 20 percent protein "protection."

Change of quantitative indices of seeding of surfaces with B. coli and staphylococcus upon BUV-ZOP (no 605) lamp irradiation'

Name of objects	Species of microbe	Number of microbes per square centimeter of surface: without oil — control	without oil — irradiated	without oil — % nondestroyed microbes	covered with diesel oil — control	covered with diesel oil — irradiated	covered with diesel oil — % nondestroyed microbes	covered with spindle oil — control	covered with spindle oil — irradiated	covered with spindle oil — % nondestroyed microbes
Linoleum	B. coli	1 300	86	6,3	824	84	10,3	445	30	6,7
Resin		1 502	24	1,6	6 482	1 460	22,5	7 764	2 019	26,0
Unpainted steel platform		2 016	214	10,6	3 740	668	17,9	3 680	868	23,6
Metallic surface painted with white oil paint		2 350	42	1,8	997	288	28,9	1 128	248	22,0
Linoleum	Staphylococcus	28 943	1 062	3,7	586	317	54,1	1 615	627	39,0
Resin		99 158	1 967	1,7	5 396	3 784	70,1	7 245	5 214	71,9
Unpainted steel platform		49 531	1 965	4,0	11 630	7 713	66,3	15 400	9 858	64,0
Metallic surface painted with white oil paint		13 093	1 082	8,0	5 491	3 380	61,5	7 198	3 567	50,0

In the table are cited data on the change in quantitative indices of seeded surfaces in irradiation of 791 microwatts/cm^2 and at a 10-minute exposure. B. Coli and staphylococcus with 20 percent protein "protection" were applied at a rate of 1,000,000 microbic bodies per square centimeter of surface. The quantities of microbes per square centimeter cited in the table represent the average figures from three experiments (144 xperiments of this type were conducted).

The data of the table attests to the fact that ultra-violet radiation, at the indicated irradiation and exposure, markedly reduces the seeding of the surfaces contaminated with B. coli and staphylococcus with 20 percent protein "Protection." Depending on the character of the surface, the percentage of microbes which remained viable comprised 1.6 to 10.6 for B. coli, and 317 to 8 -- for staphylococcus. Oily substances protected the microbes to a still greater degree from the destructive effect of ultra-violet rays. Thus, on surface covered with diesel oil 10.3 to 28.9 percent of B. coli and 54.1 to 70.1 percent of staphylococci remained alive, and on surface with spindle oil these figures were 6.7 to 26 and 39 to 71.9 percent, respectively.

Protein and fatty substances in which microbes may be present absorb ultra-violet rays and protect the bacteria from their effect. In our observations a fatty layer of 0.03- to 0.09-mm thickness proved impenetrable to ultra-violent rays, a fact which indicates their surface action.

It is commonly known that staphylococci, as compared with B. coli, possess higher resistance, as has been demonstrated by our experiments. A number of native and foreign researchers think that the higher resistance of staphylococci to the environmental factors is due to their biological peculiarity -- their arrangement in the form of "grape-clusters."

Conclusions

1. At comparatively large amounts of irradiation (791 microwatts per/cm^2) and length of exposure (up to one hour), the ultra-violet BUV-ZOP radiation does not ensure complete destruction of B. coli and staphylococci with 20 percent of protein "protection" on a surface with or without oil films.

2. BUV-ZOP lamps may be recommended as an auxilliary means of disinfection in the complex of other methods of disinfection of surfaces.

Bibliography

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